

Application Number 09/851,363
Responsive to Office Action mailed May 16, 2005

REMARKS

This amendment is responsive to the Final Office Action dated May 16, 2005. Applicant has amended claims 33-34, 42, 65 and 82. Claims 1-85 are pending.

As a preliminary matter, Applicants have amended claims 32-34, 42, and 82 to change the term "interface module" to "interface card." The term interface card is already used throughout many of Applicants' claims (16, 24, 47, 55, 63, 67, 81, 82, 83 and 85). Consequently, no new issues have been raised and no new search is required.

Claim Rejection Under 35 U.S.C. § 102

In the Office Action, the Examiner rejected claims 1-14, 16-30, 32-45, 47-61, 63-79, and 81-83 under 35 U.S.C. 102(e) as being anticipated by Wilford et al. (USPN 6,687,247). Applicants respectfully traverse the rejection. Wilford fails to disclose each and every feature of the claimed invention, as required by 35 U.S.C. 102(e), and provides no teaching that would have suggested the desirability of modification to include such features.

Claims 1-14

Applicants' claim 1 requires a router module coupled to each of the plurality of interface modules. Claim 1 further requires that the router module receive data packets from the plurality of interface modules.

Wilford fails to teach a router module that receives data packets from a plurality of different interface modules. With regard to a router module, the Examiner refers to network physical interface 210 as a router module. In addition, the Examiner refers to queue state interface and FIA 192 Interface and asserts that Wilford teaches a router module that receives data packets from a plurality of different interface modules. However, this reasoning is flawed for two reasons.

First, by no means is network physical interface 210 a "routing module." As is well known in the art, a routing module routes a data packet by accessing route data describing a topology of a network and selects a route through a network based on destination information contained in the packet. Network physical interface 210 does not route packets. In Willford, network interface module 210 merely provides a physical interface for receiving packets from

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network 1.¹ Thus, the Examiner is incorrect in asserting that network interface module 210 is a routing module.

Second, in the Wilford router, the routing functions are performed by a lookup circuit 145 (225 in FIG. 2) only for inbound packets 113 received from a single interface module, i.e., input interface 111. For example, in reference to FIG. 1, Wilford clearly states that packets 113 are received from the physical medium of the network at input interface 111. The inbound packet receiver 140 operates in conjunction with lookup circuit 145 to determine routing treatments for inbound packets 113. Thus, according to Wilford, lookup circuit 145 performs routing treatments for inbound packets 113 received from a single interface module, i.e., input interface 111. Similarly, with respect to the embodiment of FIG. 2, Wilford states that inbound packets 113 enter control element 130 from network physical interface 210 at inbound receiver 220, and that lookup circuit 225, operating in conjunction with lookup memory 227, does a destination routing lookup and a source address lookup for those packets. Thus, Wilford again makes clear that lookup circuit 225 performs routing operations for packets received from a single interface module, i.e., inbound packets 113 received from input interface 111.

It is important for the Examiner to understand that in Wilford, outbound packets 114 are not routed at all by lookup circuit 145 of that line card. Outbound packets are transferred directly from switch fabric interface 170 to network 1 via outbound receiver 260 and related hardware. FIGS 1 & 2 make clear that lookup circuits 145 & 225 perform routing lookups only for inbound packets 113 received from the single input interface of that interface card 110.

For this reason, at col. 1, ll. 51-55, Wilford states that each line card 110 of the Wilford router must include the corresponding lookup circuit 145 to route those packets received by input interface 111 for that particular interface card (line card) 110. Thus, the Examiner is clearly erroneous in asserting that Wilford teaches a router module that receives data packets from a plurality of different interface modules. Moreover, the Examiner is incorrect that Wilford teaches or suggests a router module that forwards data packets received from a plurality of interface modules in accordance with route information. Contrary to the Examiner's assertions,

¹ See, e.g., col. 5, ll. 1-10 of Wilford (stating "[a]n inbound packet (or frame) of data is received by the network physical interface 210 from network 1. In one embodiment of the present invention, network physical interface 210 consists of a Packet-Over-SONET (PoS) module which converts optical carrier signals (e.g., one OC192 or four

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lookup circuits 145 and 225 perform the routing functions for the Wilford system only for inbound data packets received from network 1 by the single input interface for that interface card and not for packets received from other interface cards. This fact is clear from FIG. 1 and FIG.

2. Lookup circuits 145 and 225 are only coupled to inbound receivers 140 and 220. There is no data path capable of providing data packets from other interface cards to the lookup circuits. The "queue state" cited by the Examiner refers to queues that buffer data packets according to architecture of FIG. 2 addressed above, and the FAI 192 interface is a particular type of output interface described by Wilford. These and the other specific implementations described by Wilford in cols. 5-10 conform to the architecture set forth in FIGS. 1 and 2 in which lookup circuits 145 (225 in FIG. 2) perform the routing functions only for inbound data packets received from network 1 by the corresponding input interface 111 (210 in FIG. 2) and not for packets received from any other interface modules.

With respect to claim 2, Wilford does not describe a routing device in which a midplane is coupled to a plurality of interface modules. In rejecting claim 2, the Examiner refers to the fabric interface 170 of FIG. 1 as a midplane. However, in FIG. 1 of Wilford, lookup circuit 145, memory controllers 150 and 160 are coupled between input interface 111 and fabric interface 170. Thus, fabric interface 170 is not coupled to input interface 111 or output interface 112 at all. This organization is directly contrary to Applicant's claim 2 that requires a midplane coupled to the plurality of interface modules and to the routing component. Switch fabric 170 satisfies none of these requirements. Hence, Wilford does not teach or suggest the requirements of claims 2.

With regard to claim 3, as amended, Wilford fails to teach or suggest a routing module that includes a packet forwarding engine that selects routes for packets received from the plurality of interface modules. As described above with respect to claim 1, lookup circuit 145 (225 in FIG. 2) perform routing functions for the Wilford system only for inbound data packets received from network 1 via a single interface (input interface 111) and not for packets received from other interface modules. Lookup circuit 145 is only coupled to inbound receiver 140, and no mechanism exists for the route lookup circuit to perform route lookups for data packets

OC48 streams) on the physical layer (layer 1 of the OSI reference model) from the SONET protocol (layer 2) into a packetized bitstream (e.g., layer 3)"))

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received from other interface modules. Thus, Wilford fails to teach or suggest a packet forwarding engine that provides routing functions for data packets received from different interface modules, as required by claim 3.

Moreover, with respect to claim 3, Wilford fails to teach or suggest a packet forwarding engine and a concentrator module integrated into a single unit separate from the interface modules. With respect to these requirements the Examiner referred to lookup circuit 145 as being interfaces 111 and 112. However, Wilford makes clear that interfaces 111 and 112 and all of the components of control element 130, including lookup circuit 145, are provided on a single interface card (line card 110). In particular, in reference to FIG. 1, Wilford clearly states that "[e]ach linecard 110 includes an input interface 111, an output interface 112, a fabric interface 170 and a control element 130." Thus, Wilford fails to teach or suggest a packet forwarding engine and a concentrator module integrated into a single unit separate from the interface modules.

With regard to dependent claim 11, Wilford fails to teach or suggest a packet forwarding module that selects routes by referencing a forwarding table, wherein the forwarding table stores route information for forwarding data packets received from any of the plurality of interface modules. As described above, FIG. 1 of Wilford makes clear that the lookup circuit 145 is only coupled to inbound receiver 140. Thus, the lookup circuit 145 performs routing functions only for packets received from the network by input interface 111 of that particular line card. In other words, in Wilford, in no way can lookup circuit 145 process packets received from interface modules other than input interface 111. Thus, no route lookup is performed at all for packets received from other line cards. Thus, Wilford does not teach or suggest a packet forwarding engine that selects routes to forward packets using a forwarding table that stores route information for forwarding data packets received from any of the different interface modules, as required by claim 11.

Dependent claims 4-10 and 12-14 are patentable for at least the reasons set forth above with respect to claim 1.

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Claims 16-30

Independent claim 16 requires a router module comprising a packet processing circuit, a memory management circuit, and a route lookup circuit integrated into a single module separate from a plurality of "interface cards." Claim 16 specifically requires that the route lookup circuit be separate from a plurality of interface cards. In rejecting claim 16, the Examiner refers to Wilford and states that route lookup circuit 145 (225 in FIG. 2) is separate from "interfaccs cards 113 and 114."

First, Applicant points out that in Wilford, elements 113 and 114 of Wilford refer to an inbound packet 113 and an outbound packet 114. Thus, the Examiner is incorrect with respect to her construction of Wilford in this regard. Moreover, Wilford refers to interface cards as "line cards 110" and Wilford makes clear that all of the components of control element 130 and interfaces 111 and 112 are provided on a single interface card (line card 110). In particular, Wilford states that "[e]ach linecard 110 includes an input interface 111, an output interface 112, a fabric interface 170 and a control element 130."

Thus, Wilford fails to teach or suggest a route lookup circuit integrated into a single module separate from a plurality of "interface cards," as required by claim 16. Directly to the contrary, lookup circuits 145 and 225 are provided on a single card 110 along with interfaccs 111 and 112.

With regard to dependent claim 24, Wilford fails to teach or suggest a packet forwarding module that selects routes by referencing a forwarding table, wherein the forwarding table stores route information for forwarding data packets received from any the plurality of interface cards. As described above, FIG. 1 of Wilford makes clear that the lookup circuit 145 is only coupled to inbound receiver 140 and only performs routing functions for packets received from the network by that particular line card. In no way can lookup circuit 145 perform route lookup for packets received from other line cards. Thus, in no manner does Wilford teach or suggest a packet forwarding engine that selects routes to forward packets using a forwarding table that stores route information for forwarding data packets received from any of the different interface cards, as required by claim 24.

With respect to claim 30, the Examiner states that Wilford describes a packet processing circuit configured to build an L2 header, as required by Applicants' claim. However, the cited

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portion of Wilford merely states that the Wilford controller "compares" a packet payload length of an L2 header when forwarding a packet. Comparing a payload length in an L2 header of a received packet is entirely unrelated to actually building an L2 header, as required by Applicant's claims. Thus, the Examiner has failed to address the elements of Applicants' claim 30 and has failed to establish a prima facie case for anticipation of claim 30.

Dependent claims 17-23, 25-29 and 31 are patentable for at least the reasons set forth above with respect to claim 16.

Claims 32-45

Applicants have amended claim 32 in a manner consistent with claim 16 to require that at least one of the routing devices include a router module separate from a plurality of interface cards to process data packets from the interface cards and forward the data packets between the interface cards.

In rejecting claim 32, the Examiner again refers to elements 113 and 114 as interfaces. As noted above, elements 113 and 114 of Wilford refer to an inbound packet 113 and an outbound packet 114, respectively. Further, Wilford makes clear that all of the components of a line card (e.g., control element 130 and lookup circuit 145) as well as interfaces 111 and 112 are provided on a single line card. Thus, Wilford fails to teach or suggest a router module separate from a plurality of "interface cards," as required by claim 32. Directly to the contrary, in Wilford, lookup circuits 145 and 225, input interface 111 and output interface 112 are provided on the same card 110.

With respect to claim 33, Wilford makes no mention of a midplane coupled to the plurality of interface modules and to the router module. As described in detail above with respect to Applicants' claim 2, in the Wilford system lookup circuit 145 and memory controllers 150 and 160 are coupled between input interface 111 and fabric interface 170. Thus, it cannot be said that fabric interface 170 is a midplane coupled to a plurality of interface modules. Fabric interface 170 is not coupled to a plurality of interface modules (i.e., interfaces 111 and 112 or network physical interface 210). Instead, fabric interface 170 of Wilford is coupled to lookup circuit 145 and memory controllers 150 and 160.

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With respect to claims 34, Wilford does not disclose or suggest a memory management circuit that provides data to a concentrator that is separate from a plurality of interface cards, as described in detail above with respect to claim 4. To the extent that control unit 130 can be viewed as a "concentrator," as asserted by the Examiner, the control unit is provided by the same line card 110 that provides interfaces 111 and 112. Thus, Wilford clearly fails to teach or suggest a concentrator separate from the plurality of line cards.

With regard to dependent claim 42, Wilford fails to teach or suggest a control module that selects routes by referencing a forwarding table, wherein the forwarding table stores route information for forwarding data packets received from any the plurality of interface cards. As described above, FIG. 1 of Wilford makes clear that the lookup circuit 145 is only coupled to inbound receiver 140 and performs routing functions only for packets received from the single input interface of that particular line card. In no way can lookup circuit 145 perform route lookup for packets received from other line cards. Thus, in no manner does Wilford teach or suggest a control module that selects routes to forward packets using a forwarding table that stores route information for forwarding data packets received from any of the different interface cards, as required by claim 42.

Dependent claims 35-41 and 43-45 are patentable for at least the reasons set forth above with respect to claim 32.

Claims 47-61

Independent claim 47 requires a router module separate from the plurality of interface cards to process data packets and to forward the data packets between the interface cards. As described above, Wilford makes clear that all of the control element 130, lookup circuit 145 and interfaces 111 and 112 are provided on within line card 110. Thus, contrary to the Examiner's assertion, interfaces 111 and 112 are not interface cards separate routing lookup circuit 145. Quite the opposite, interfaces 111 and 112 are on the same card as the routing lookup circuit 145.

With regard to dependent claim 55, Wilford fails to teach or suggest a route lookup circuit that selects routes by referencing a forwarding table, wherein the forwarding table stores route information for forwarding data packets received from any the plurality of interface cards. As described above, FIG. 1 of Wilford makes clear that the lookup circuit 145 is only coupled to

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inbound receiver 140 and only performs routing functions for packets received from input interface 111 of that particular line card. Thus, in no way can lookup circuit 145 perform route lookup for packets received from other interface cards. Packets from other interface cards (i.e., outbound packets) are not even sent to lookup circuit 145. Thus, in no manner does Wilford teach or suggest a route lookup circuit that selects routes to forward packets using a forwarding table that stores route information for forwarding data packets received from any of the different interface modules, as required by claim 55.

With respect to claim 61, the Examiner states that Wilford describes a packet processing circuit configured to build an L2 header. However, the cited portion of Wilford merely states that the Wilford controller "compares" a packet payload length of the L2 header when forwarding a packet. This is entirely unrelated to building an L2 header, as required by Applicant's claims. Moreover, the Examiner entirely overlooks the requirements of claim 61 of "rewriting an L3 header for an outbound data packet." Thus, the Examiner has failed to establish a prima facie case for anticipation of claim 61.

Dependent claims 48-54 and 56-60 are patentable for at least the reasons set forth above with respect to claim 47.

Claims 63-70

Independent claim 63 requires a router comprising one hardware board integrally housing an interface concentrator that provides electrical interfaces to receive incoming packets from a plurality of interface cards, a packet processing circuit, a memory management circuit, and a route lookup circuit to select routes for the incoming packets received from the plurality of interface cards.

In rejecting claim 63, the Examiner again states that Wilford teaches "a route lookup circuit to select routes for the incoming packets received from the plurality of interface cards." Again, the Examiner has misunderstood the architecture of the Wilford router in which lookup circuit 145 (225 in FIG. 2) only performs routing functions for packets received from the single input interface of that particular line card. Packets from other interface cards (i.e., outbound packets) are not even sent to the lookup circuit (145 & 225). Thus, in no way does Wilford teach

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a route lookup circuit to select routes for the incoming packets received from the plurality of interface cards.

With respect to claim 67, Wilford fails to teach a route lookup circuit that selects routes by referencing a forwarding table, wherein the forwarding table stores route information for forwarding data packets received from any the plurality of interface cards. As described above, FIG. 1 of Wilford makes clear that the lookup circuit 145 is only coupled to inbound receiver 140 and only performs routing functions for packets received from input interface 111 of that particular line card. Thus, in no way can lookup circuit 145 perform route lookup for packets received from other interface cards. Packets from other interface cards (i.e., outbound packets) are not even sent to lookup circuit 145. Thus, in no manner does Wilford teach or suggest a route lookup circuit that selects routes to forward packets using a forwarding table that stores route information for forwarding data packets received from any of the different interface modules, as required by claim 67.

With respect to claim 70, the Examiner states that Wilford describes a packet processing circuit configured to build an L2 header. However, the cited portion of Wilford merely states that the Wilford controller "compares" a packet payload length of the L2 header when forwarding a packet. This is entirely unrelated to building an L2 header, as required by Applicant's claims. Moreover, the Examiner entirely overlooks the requirements of claim 70 of "rewriting an L3 header for an outbound data packet." Thus, the Examiner has failed to establish a prima facie case for anticipation of claim 70.

Dependent claims 64-66 and 68-69 are patentable for at least the reasons set forth above with respect to claim 63.

Claims 71-79

Independent claim 71 requires coupling a plurality of interface modules to a single router module. In rejecting claim 71, the Examiner refers to network physical interface 210 as a router module. As explained above, by no means is network physical interface 210 a "routing module." This physical interface performs no routing functions.

Second, in the Wilford system, routing functions are performed by lookup circuit 145 (225 in FIG. 2), which is coupled to a single interface module, i.e., input interface 111. Lookup

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circuit 145 only processes inbound packets 113 and is not coupled to a plurality of interface modules.

To the extent the Examiner reasons that lookup circuit 145 is coupled to other interface modules via switch fabric 120, then the lookup circuits 145 for all of the line cards are so coupled. As a result, even under this construction Wilford does not describe a plurality of interface modules coupled to a single router module, as required by claim 71. Applicant's claim 71 is specifically limited to a plurality of interface modules being coupled to and serviced by a single router module.

With respect to claim 72, Wilford makes no mention of a routing device comprising a midplane coupled to the plurality of interface modules and to the router module that forwards packets received from the different interface modules in accordance with routing information. As described in detail above with respect to Applicants' claim 2, in the Wilford system lookup circuit 145 and memory controllers 150 and 160 are coupled between input interface 111 and fabric interface 170. Thus, it cannot be said that fabric interface 170 is a midplane coupled to a plurality of interface modules. FIGS. 1 and 2 of Wilford make clear that fabric interface 170 is not coupled to a plurality of interface modules (i.e., interfaces 111 and 112 or network physical interface 210).

With respect to claim 73, Wilford fails to teach or suggest a system control module and a concentrator module integrated into a single unit separate from the interface modules. In the Wilford system, each line card provides interfaces 111, 112 and router lookup circuits 145 or 225.

With regard to dependent claim 78, Wilford fails to teach or suggest a system control module that selects routes by referencing a forwarding table, wherein the forwarding table stores route information for forwarding data packets received from any of the plurality of interface modules. As described above, FIG. 1 of Wilford makes clear that the lookup circuit 145 is only coupled to inbound receiver 140 and performs routing functions only for packets received from the network by that particular interface. In no way can lookup circuit 145 perform route lookup for packets received from other line cards. Thus, in no manner does Wilford teach or suggest a packet forwarding engine that selects routes to forward packets using a forwarding

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table that stores route information for forwarding data packets received from any of the different interface modules, as required by claim 78.

Dependent claims 74-77 and 79 are patentable for at least the reasons set forth above with respect to claim 71.

Claim 81

Independent claim 81 requires providing a routing module separate from the plurality of interface cards. In rejecting claim 81, the Examiner refers to FIG. 1 and col. 17 of Wilford, which describes a receive ASIC (RX ASIC) that performs the functions of lookup circuit 225. Thus, the receive chip (ASIC) of Wilford is generally unrelated to Applicants' requirements of providing a routing module separate from a plurality of interface cards.

As discussed in detail above, Wilford makes clear that control element 130, lookup circuit 145 and interfaces 111 and 112 are provided on each card. For example, in reference to FIG. 1, Wilford clearly states that "[e]ach line card 110 includes an input interface 111, an output interface 112, a fabric interface 170 and a control element 130." Thus, Wilford fails to teach or suggest providing a router module separate from a plurality of "interface cards," as required by claim 81. Directly to the contrary, in Wilford, lookup circuits 145 and 225 are provided on line cards 110 along with input interface 111 and output interface 112.

Claims 82 and 83

Similarly, for at least the reasons set forth above, Wilford fails to teach or suggest a router module separate from the plurality of interface cards to process the data packets and to forward the data packets between the interface modules, as required by independent claims 82 and 83. As discussed in detail above, Wilford makes clear that control element 130, lookup circuit 145 and interfaces 111 and 112 are provided on each card and, therefore, are not separate from the interface cards. In Wilford, each line card is an interface card. Moreover, columns 14-19 referred to by the Examiner describe an implementation of control element 130 having three distinct ASICs (RX, MCC and TC ASICs). Nevertheless, these ASICs are provided on each interface card of Wilford. Thus, Wilford does not describe a router module separate from the plurality of interface cards.

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In order to support an anticipation rejection under 35 U.S.C. 102(e), it is well established that a prior art reference must disclose each and every element of a claim.² Wilford fails to disclose each and every limitation set forth in claims 1-14, 16-30, 32-45, 47-61, 63-79, and 81-83. For at least the reasons set forth above, Wilford fails to establish a prima facie case for anticipation under 35 U.S.C. 102(e). Withdrawal of this rejection is requested.

Claim Rejection Under 35 U.S.C. § 103

In the Office Action, the Examiner rejected claims 15, 31, 46, 62, 80, 84 and 85 under 35 U.S.C. 103(a) as being unpatentable over Wilford in view of Zadikian et al. (USPN 6,724,757). Applicants respectfully traverse the rejection. Wilford and Zadikian fail to disclose or suggest the inventions defined by Applicants' claims, and provide no teaching that would have suggested the desirability of modification to arrive at the claimed invention.

In general, Zadikian fails to overcome the deficiencies of Wilford. For example, similar to Wilford, Zadikian describes a router having a plurality of line cards coupled via a switch matrix. Zadikian makes clear that the line cards (interface cards) of the described router perform route selection and forwarding functions:

*The line card terminates an input signal from one of the other nodes in the network. For example, in a SONET-based implementation, a single SONET/SDH OC-48 signal is terminated by an a line card, although other signal levels (OC-192, OC-12, and so on) may be supported. In one embodiment, the software consists of two threads, one that runs in the background and is responsible for non-time critical tasks. The other thread, which runs at the interrupt level, is responsible for all real-time aspects of the software, including limited overhead processing, alarm detection and forwarding, and fault detection and recovery. The line card processor maintains a copy of its firmware and startup code onboard.*³

In regard to claims 15, 31, 46, 62, and 80, the Examiner correctly recognized that Wilford fails to teach or suggest a redundant router module to process the data packets and to forward the data packets between the interface modules in response to malfunction of the router module. Similarly, with respect to claims 84 and 85, the Examiner correctly recognized that Wilford fails to teach or suggest a switch arrangement coupled to the plurality of routing devices and configured to switch control from a first routing device to a second routing device. However, the

² See *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 231 USPQ 81 (CAFC 1986) ("it is axiomatic that for prior art to anticipate under 102 it has to meet every element of the claimed invention").

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Examiner suggests that it would have been obvious to modify the Wilford routing device in view of the Zadikian to include a redundant router module.

Applicants respectfully point out that even if modified as suggested by the Examiner, Applicants' claimed invention would not be achieved. For example, both Wilford and Zadikian describes routers in which each line card requires an internal control element that performs routing functions for only those packets received from the network by the input interface of that particular line card. Thus, as Zadikian makes clear, redundancy is accomplished by utilizing groups of redundant line cards.⁴ For example, Zadikian states "[p]referably, the group matrix is a 2:1 reduction stage that selects output signals from one of two line cards."⁵ In fact, this point illustrates one of the many fundamental differences between Applicants' claimed invention and the applied references. The Wilford and Zadikian routers require localized routing functions within each line card, and redundancy can only be achieved with the addition of multiple line cards.

Neither Wilford nor Zadikian describe a separate router module capable of forwarding data packets received from any of the plurality of interface modules. As result, neither the Wilford routing device nor the Zadikian routing device is capable of being modified to include a redundant router module capable of providing similar functionality.

For at least these reasons, the Examiner has failed to establish a prima facie case for non-patentability of Applicants' claims 15, 31, 46, 62, 80, 84 and 85 under 35 U.S.C. 103(a).
Withdrawal of this rejection is requested.

³ Col. 21, ll.50-62 (emphasis added).

⁴ See, e.g., cols. 6-8.

⁵ Col. 8, ll. 21-23.

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CONCLUSION

All claims in this application are in condition for allowance. Applicant respectfully requests reconsideration and prompt allowance of all pending claims. Please charge any additional fees or credit any overpayment to deposit account number 50-1778. The Examiner is invited to telephone the below-signed attorney to discuss this application.

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